

Development of a Telemedicine Evaluation Model

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Telecommunications and advanced information technologies have increasingly been used for clinical activities, education, administration, and research to improve health care delivery. With this growth in use, these technologies have undergone many investigations to evaluate their effectiveness and efficiency.

It is very important for telemedicine to be evaluated aggressively on a continuing, expansive, appropriate, and comprehensive basis. However, as reported elsewhere¹⁻³, many evaluative investigations have been incomplete or have applied inappropriate techniques in the evaluation process, especially when attempting to evaluate the cost-effectiveness of medical technologies.

Because of the wide diversity of activities involved in telemedicine, it is critical that a systematic framework be developed for use in evaluating its effectiveness, efficiency, and feasibility. Historically, clinical trial research in medicine has focused on the issues of the safety, efficacy, and effectiveness of medical technologies. Recently, medical research has been broadened to include economic feasibility and implications. As the content expands, researchers must incorporate additional theories and tools, and research teams must become truly interdisciplinary.

In a clinical setting, evaluation attempts to determine what occurs in the prevention, diagnosis, treatment, or eradication of a particular disease or illness with the application of a particular medication, procedure, device, or behavior modification strategy. Economic evaluations add the determination of the resources that would have to be expended to implement the intervention.

The primary theoretical foundation involved in the development of the comprehensive telemedicine evaluation model presented in this paper is transactional economics, more often referred to as "transaction cost economics"⁴. The basis for this is the numerous individuals and organizations involved in the production of health and health care services, many of whom interact (perform transactions) with each other on a continuing or

periodic basis. These transactions drive the quality, cost, and access associated with the system. When a telecommunications structure is superimposed on many of these transactions, the scope and complexity of the transactions are modified, magnified, or changed in some way. The evaluation model must now examine the extent to which the changes in the transactions result in an improvement or deterioration in the health of the population, the cost associated with that level of health, and the access stakeholders have to that system.

Adding telemedicine to the health services equation can be evaluated through its impact on transactional distance. Transactional distance refers to any factor having an impact on the interaction that creates distance between the parties—education, knowledge base, culture, ethnicity, gender, health status, etc⁵. Geography primarily creates distance through time and space. When parties are geographically dispersed, there can be substantial costs associated with traveling to a mutual location where the exchange can occur. It is then incumbent on the parties to the transaction to minimize the transactional distance to the extent possible. The value of the transaction will be enhanced with the reduction of this distance.

One of the first steps in any analysis is to identify the perspective involved in the analysis. As the Missouri team explored the different evaluation studies that could be performed, it became obvious that a structured approach would be required if all of the perspectives were to be identified. Although it was impossible for the team to perform a single, comprehensive evaluation, including all aspects, the development of a comprehensive evaluation model played an integral role in the selection and structure of the numerous projects that were performed. This model assisted in identifying the strengths and weaknesses of the completed evaluation and provided a framework for identifying those areas in need of more examination. In this process, the team identified three specific dimensions that would need to be considered in an evaluation: (1) level of analysis, (2) focus of analysis, and (3) activities of analysis.

The first dimension considered is the level of analysis. Three broad levels of analysis can be identified—individual, community, and societal. The second dimension is concerned about the focus of the analysis. When health care is discussed, there are generally one or more of three major themes being addressed: cost, quality, and/or access. The third dimension involves the activities of analysis. Once the technology and equipment are in place, telecommunication activities can take place for a variety of reasons—clinical, educational, or administrative.

These three dimensions of analysis on which evaluation studies are performed are shown in Figure 1. The top of the cube represents a variety of stakeholders, or the level of analysis. The front of the cube represents the driving forces of health care, or the focus of analysis. The end of the cube represents the different uses of telemedicine, or the activities of analysis. All evaluations examine at least one of the cells; as the studies become more comprehensive, multiple cells are involved. For instance, clinical studies may use an individual or community approach, while examining both cost and quality issues.

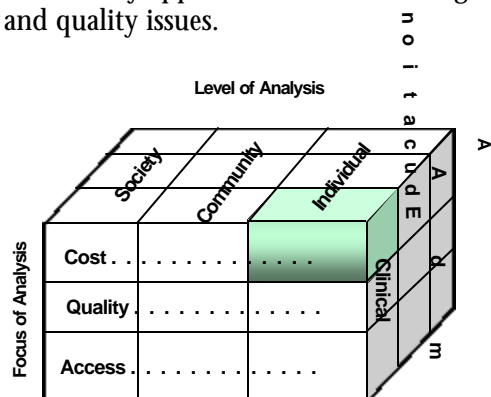


Figure 1. Three Dimensions of Analysis for Evaluation Studies

One study conducted by the Missouri team is illustrated by the shaded cell in Figure 1. In this study, the financial (cost) implications of using telecardiology as a substitute for face-to-face encounters were evaluated from the perspective of the hub facility (individual, clinical, cost cell).

A second study evaluated the financial implications for rural hospitals of avoiding transferring patients from their emergency departments. Economic multipliers were used to estimate the impacts on communities of retaining these dollars locally. This study involved both the individual facility and the community in terms of the costs of a clinical service.

In a third study, telemedicine was evaluated in terms of an increase in access to a clinical service (dermatology) and the implied improvement in quality resulting from that increased access for the individual involved. In addition to the improved access, patients expressed high levels of satisfaction with the telemedicine service.

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